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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/713,215	11/17/2003	Tac-Wan Kim	249/392	2486

7590 01/09/2006

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EXAMINER	
BERNATZ, KEVIN M	
ART UNIT	PAPER NUMBER
1773	

DATE MAILED: 01/09/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/713,215	KIM ET AL.	
	Examiner	Art Unit	
	Kevin M. Bernatz	1773	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *24 October 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2 and 4-8* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2 and 4-8* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 October 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Amendments to the specification and claims 1, 2 and 4 – 7, and cancellation of claims 3 and 9 - 21, filed on October 24, 2005, have been entered in the above-identified application.

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 102

3. Claims 1, 2 and 4 – 8 are rejected under 35 U.S.C. 102(e) as being anticipated by Hiramoto et al. (U.S. Patent No. 6,771,473 B2) .

Regarding claim 1, Hiramoto et al. disclose a magnetic tunnel junction device (*col. 1, lines 10 – 15*) comprising a substrate (*Example 3 – silicon*), a seed layer (*Example 3, esp. col. 13, lines 48 – 63: "Ta(3)/Cu(500)"*), a pinning layer (*"Cr(2.2)"*), a pinned layer having a second region/surface (*"Co(2)"*) and a first region/surface (*"FeN(1)" per teachings in lines 50 – 53*) wherein a nitrogen-rich region exists at the interface of the first surface of the pinned layer and the first surface of the tunnel barrier layer, the nitrogen rich region containing more nitrogen than the pinned layer contains at a second surface of the pinned layer opposite to the interface (*i.e. FeN contains >0% N versus Co containing 0% N*). Hiramoto et al. further disclose a first surface of the tunnel barrier layer (*Table 3 – "AlN" in last embodiment listed*) that is adjacent to the first

surface of the pinned layer (*i.e. the FeN layer described above*) wherein the nitrogen-rich region (*i.e. the "FeN(1)" of the pinned layer and the AlN of the barrier layer*) contains more nitrogen than the tunnel barrier contains at a second surface of the tunnel barrier opposite to the interface (*while not explicitly disclosed in an embodiment in Table 3, the Examiner notes that the middle BN layer is taught to be many non-Nitrogen containing layers – see rest of examples in Table 3, as well as col. 3, lines 1 – 54*). The Examiner further notes that Example 8 of Hiramoto et al. explicitly teaches an intermediate layer comprising a layer having a composition of $AlN_{1.0}$ adjacent the pinned layer, followed by a layer of $AlN_{0.7}$ and $AlN_{0.5}$ (i.e. the Nitrogen concentration decreasing away from the interface with the pinned layer) (*Table 7, middle embodiment*).

Regarding claim 2, Hiramoto et al. disclose the claimed limitations as described above.

Regarding claims 4 and 5, Hiramoto et al. disclose seed and pinning layers meeting applicants' material limitations (*col. 8, lines 5 – 16*).

Regarding claim 6, Hiramoto et al. disclose pinned layers meeting applicants' claimed limitations, including FeCoN (*col. 8, lines 17 – 40*).

Regarding claim 7, Hiramoto et al. disclose the claimed limitations as described above.

Regarding claim 8, Hiramoto et al. disclose barrier layers meeting applicants' claimed limitations (*i.e. instead of AlN, AlON is taught as equivalent for the outer "high barrier" layer – col. 3, lines 33 – 40*).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1, 2 and 4 – 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hiramoto et al. ('473 B2) as applied above.

Hiramoto et al. is relied upon as described above.

While the Examiner maintains that there is sufficient specificity in the relied upon reference to anticipate the claimed invention, the Examiner acknowledges that Hiramoto et al. fail to explicitly disclose a single embodiment possessing all the claimed limitations, even though the claimed limitations are disclosed through-out the reference.

However, the Examiner deems that AlN, AlON and BN are known equivalents to the AlOx taught as the outer "high barrier" layers in Example 3 and Nitrogen containing Ferromagnetic alloys are known equivalents to the Fe layer in Example 3, in both cases as taught by Hiramoto et al. (*col. 3, lines 33 – 40; col. 8, lines 17 – 40 and Examples*).

Substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. In the instant case, the above materials are all known equivalents in the field of barrier layers and pinned layers in the magnetic head art. *In re Fount* 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *Graver Tank & Mfg. Co. Inc. v. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

Furthermore, the Examiner maintains that one of ordinary skill in the art would have been motivated to use a barrier layer of AlON as the "high barrier" layer and a non-nitride containing material as the "low barrier" layer, given that AlON is one of the few materials shown in Table 1 to possess both a high MR% (≥26%) and a low RA (≤10 $\Omega\mu m^2$) while the majority of materials disclosed for the "low barrier" layer are non-Nitrogen containing layers (*col. 3, lines 41 – 50 and Example 3*).

It would therefore have been obvious to one of ordinary skill in the art at the time of the applicant(s) invention to modify the device of Hiramoto et al. to result in an embodiment reading on applicants' claimed limitations, since Hiramoto et al. provides sufficient guidance to utilize Nitrogen containing ferromagnetic layers in combination with a Nitrogen-containing "high barrier" layer and a non-Nitrogen containing "low barrier" layer.

Regarding claim 2, Hiramoto et al. disclose the claimed limitations as described above.

Regarding claims 4 and 5, Hiramoto et al. disclose seed and pinning layers meeting applicants' material limitations (*col. 8, lines 5 – 16*).

Regarding claim 6, Hiramoto et al. disclose pinned layers meeting applicants' claimed limitations, including FeCoN (*col. 8, lines 17 – 40*).

Regarding claim 7, Hiramoto et al. disclose the claimed limitations as described above.

Regarding claim 8, Hiramoto et al. disclose barrier layers meeting applicants' claimed limitations (*i.e. instead of AlN, AlON is taught as equivalent for the outer "high barrier" layer – col. 3, lines 33 – 40*).

Response to Arguments

6. General Comments regarding the language "pinned" and/or "fixed"

Applicants contend that the Examiner's assertion that the accepted meaning of "fixed layer" is incorrect, pointing to a reference by Dr. Slaughter as evidence (*page 7 of response*). The Examiner respectfully disagrees.

While the issue is moot given the current claim language, the Examiner notes that Dr. Slaughter is referring to *magnetic* layers making up a synthetic pinned/fixed layer structure (*the general name for such a structure is a synthetic antiferromagnetic structure, or SAF, since the two sublayers have magnetization directions that are coupled antiferromagnetically – i.e. in an antiparallel state*). He appears to be attempting to use the different nomenclature to distinguish between the upper and lower sublayers of what is *still* the "pinned" or "fixed" magnetic layer in his MR element. First, the Examiner notes that Dr. Slaughters use of such nomenclature is still unconventional to what one of ordinary skill in the art would use, but that it also conveys the same reasoning that the Examiner initially relied upon for the prior 112 2nd Paragraph rejection. The nomenclature "pinned" or "fixed" conveys structure to the layer in the sense that the magnetization direction is "pinned" or "fixed" in response to an external magnetic field. These layers are ferromagnetic layers and, in the case of a SAF

structure, laminates of alternating ferromagnetic/non-magnetic layers. The Examiner maintains that one of ordinary skill in the art would not associate a "seed layer" and a "pinning layer" as being encompassed by a "pinned" or "fixed" layer.

7. The rejection of claims 1 and 3 - 8 under 35 U.S.C § 102(a) and/or (e) – Hiramoto et al. ('723 A1)

The rejection of claims 1 and 3 - 8 under 35 U.S.C § 102(b) – Gill ('177)

The above noted rejections have been withdrawn because applicant(s) amendment(s) have set forth new limitations (e.g. "a first surface of the tunnel barrier layer is adjacent ... at a second surface of the tunnel barrier layer opposite to the interface") no longer anticipated, nor rendered obvious, by the above noted rejection.

8. The rejection of claims 1 and 3 - 8 under 35 U.S.C § 102(e) – Hiramoto et al. ('473 B2)

Applicant(s) arguments have been considered but are moot in view of the new ground(s) of rejection. In so far as they apply to the present rejection of record, applicant(s) argue that "the fixed layer is properly characterized as including FeN, and FeN is not a buffer layer" (*page 11 of response*). The Examiner respectfully disagrees.

Applicants are reminded that the specification is not the measure of the invention. Therefore, limitations contained therein can not be read into the claims for the purpose of avoiding prior art. *In re Sporck*, 55 CCPA 743, 386 F.2d 924, 155 USPQ 687 (1968). In the instant case, the present claims do not require a "buffer layer", only

"nitrogen-rich" regions of the barrier and pinned layer. Furthermore, even if nitrogen-rich region at the first surface of the pinned layer was recited as being a separate "buffer layer", the claim would still not exclude FeN as reading on such language. Should applicants desire to exclude FeN and other magnetic nitrides from reading on the nitrogen-rich regions, the Examiner recommends positively reciting what materials comprise the nitrogen-rich regions.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Applicants' amendment resulted in embodiments not previously considered (i.e. "a first surface of the tunnel barrier layer ... barrier opposite to the interface") which necessitated the new grounds of rejection, and hence the finality of this action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M. Bernatz whose telephone number is (571) 272-1505. The examiner can normally be reached on M-F, 9:00 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carol Chaney can be reached on (571) 272-1284. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Kevin M. Bernatz, PhD
Primary Examiner

KMB
January 4, 2006